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CLINICAL CONTRIBUTIONS TO THE SUBJECT OF BRAIN-SURGERY.

BY

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IT is my intention in the following paper to report and comment upon certain personal expe riences in the rather new field of intra-cranial surgery, illuminated, as it has been, by the light of recent researches, rather than to endeavor to present any new aspects of the subject. After one has done a certain amount of this kind of work, his experience and deductions become of value to others, and the sole purpose of the present communication is to make it as helpful to others as possible. I do not intend to touch upon all possible phases of the subject, but rather upon some of the more common cases of this general character; neither is this intended to be a comprehensive or complete personal record. The instances reported are simply some that have been selected from a much larger number because they appear to me to be of interest. Hence the frequent use of the personal pronoun.

INTRA-CRANIAL ABSCESS.

As is well known, abscess of the brain must be the result either of direct infection or of embolic

disturbance. It is sometimes easy to trace the latter; explanation of the former is frequently much more difficult. While it is generally acknowledged that abscess of the brain may follow external injury to the skull, it is usually difficult to fully appreciate the minute mechanism of its production, and although a collection of pus may be found directly beneath and two inches below an external scar, we may be absolutely unable to demonstrate the path pursued by the agents that have produced it. In the following case, which I shall briefly report, the path of infection is made reasonably clear.

The case concerns a lady approaching elderly life, from whose upper nasal passage on one side a polyp was removed by Dr. Hinkel, of Buffalo. At first she did well; but, later, rather severe nasal symptoms presented themselves, and at the expiration of about four weeks she developed brain-symptoms and became unconscious. In this condition, Dr. Putnam, together with Dr. Hinkel, diagnosticated a probable brain-abscess. With these two gentlemen, I saw the woman and fully concurred in their diagnosis. In this comatose condition there were no localizing symptoms whatever, and it was from inference, rather than from any safer guide, that we decided to explore the frontal lobe. Accordingly, without an anesthetic, I raised a frontal flap, and made a good-sized trephine-opening about 2.5 cm. above the orbit on the side from which the polyp had been removed. After opening the dura, which appeared normal, I used the needle of an exploring syringe and passed it in in several directions, once quite through the falx and 3 cm. into the other hemisphere, searching for pus. Upon the fourth or fifth attempt it was found directly back of the

trephine-opening, and at a depth of about 3 cm. The abscess-cavity was then freely opened, and 12 c.c. of fresh pus were evacuated. The cavity was drained with rubber tubing, and the wound closed and dressed.

The patient never recovered consciousness, but died the following day. Examination was fortunately permitted, and it was found that on the other side, in almost exactly the corresponding locality, was a similar collection of pus of about the same amount. The point of my needle must have gone within a very short distance of it, although it was completely missed.

Here was a case similar to others that have been noted, in which the surgeon is deluded into contenting himself with the discovery of one brain-abscess, while more or less narrowly missing others in its neighborhood. At the same time it must be said that there was absolutely nothing about the case to lead to a suspicion of trouble other than that discovered, which seemed ample for an explanation of the symptoms presented.

The case is also of pathologic interest, as it gives a clinical demonstration of recently discovered anatomic facts concerning the lymph-vascular connection between the nasal region and the encephalon. It moreover indicates a possible source of danger in operations within the nasal cavity.

Hemorrhage.

One of the most complete demonstrations of the formation of clot, and the proper measure for its removal, that I have ever seen, was the following:

In February, 1889, a young man in an adjoining town was injured by a falling board, which inflicted a large scalp-wound near the left parietal eminence. He was stunned, but quickly recovered consciousness, and was attended by a local physician, who showed himself not keenly alive to modern practice in this regard, and who sewed up the scalp-wound without any of the precautions at present customary. He was then put on the train and sent to the Buffalo General Hospital, which he reached in the evening. On his arrival at the station, where he was met by the ambulance, it was noted that he used his right arm, but that during the quarter of an hour spent in the removal to the institution he lost the use of it. When he entered the hospital he was able to talk, but within half an hour he lost his power of speech, and within an hour was completely aphasic, with right brachial monoplegia. I did not see him until the following morning, when the house-staff had him ready for operation. His condition had not become aggravated during the night. Naturally the diagnosis was that of clot pressing upon certain centers, and the indication for operation was most plain. After anesthetizing him, I found considerable external injury of the soft parts, with apparently local signs of infection. After such cleansing and disinfection as was possible, I found a depressed fracture about the size of a nickel five-cent piece.

The trephine was applied at a point over the arm-center and speech-center, and a considerable portion of slightly depressed bone was removed, its inner table being considerably splintered. There was no laceration of the dura, which, however, was dark in hue and bulged into the wound. Upon making a small incision a piece of clot was expelled from the dural wound, and literally ejected to a distance of fifteen or eighteen inches, showing the degree of

intra-cranial pressure. Enlarging the incision, a considerable quantity of clot, fully two tablespoonfuls, was removed with probe, spoon, and irrigating stream. A number of small brain-fragments were also extruded, showing that there had been laceration beneath the unbroken dura.

His condition was not materially changed by the operation, and three days later the wound was found united without any pus. On the following day, however, the temperature quickly rose, the flap bulged somewhat, and upon removing some stitches considerable pus was discharged. It will be sufficient to state, in this case, that the patient manifested no improvement, but became weaker and died some weeks later, and that upon autopsy three deep abscesses were found, apparently in the path of motor conduction, which would probably account for the fact that no new localizing symptoms developed themselves.

This was clearly an instance of primary infection from a head-injury, which subsequent endeavors were powerless to avert, and illustrates very forcibly the general statement that the fate of such cases is really in the hands of the man who first attends them. A corollary is that if the first aid rendered is not based upon aseptic principles, the case is usually thereby placed beyond the pale of surgical help.

Another case of hemorrhage of different character and happier termination is the following:

A lad of fifteen was, in June of the present year, struck on the right side of his head by a wagon and was unconscious for a time. There was no distinct scalp-wound, only some bruising and ecchymosis. He was attended first by Dr. Schlader-

mund, later by Dr. Dorr. With these gentlemen I saw him six days later. In the meantime no motor or localizing symptoms had developed, but on the previous day his temperature had begun to rise, and he had become very peevish and restless, although he was up and about the house. I could easily feel a flattened and depressed area back of the right parietal eminence. After shaving the scalp it was found ecchymotic above and behind the ear. On raising it the periosteum was found separated from the underlying bone, and an irregular, V shaped, linear fissure with depression was found. The trephine was applied 5 cm. away from the ear, on a line from the meatus to the vertex. Immediately upon raising the button of bone, I came upon a very firm extra dural clot in which organization had begun, and which, after cutting away a large amount of bone, I found to cover an area 6 by 10 cm. (equal to 60 sq. cm.), and to be at least 1½ cm. thick in its central portion. So tenacious was it that it was removed only with considerable difficulty. After its removal the brain did not at once rise to its proper level, and I did not think it necessary to open the dura. The wound was closed without drainage, and rapid and perfect recovery ensued.

I have seen many large flat clots inside and outside the dura, but never before had thought it possible that a clot of this size and thickness could form with so little mental, psychic, or motor disturbance.

Fractures.

The following cases of aggravated and fatal fracture seem to me worthy of mention:

The first was that of a middle-aged man who fell

upon a slippery sidewalk and struck upon the back of the head, although his head did not receive the full violence of the fall. He was unconscious from the time of the injury, and was brought to the hospital, and was operated on in the evening a few hours after his injury. At this time he was profoundly comatose, in a rather bad condition generally, with a scalp-wound upon the right side of the head, and an evident depressed fracture. Without an anesthetic, a large flap was raised and revealed an astonishing condition of multiple fracture extending in all directions, the fragments being more or less interlocked until disturbed, after which the more I picked out the more dislocated did the others become, and it seemed as if the skull were cracked into a number of pieces. After commencing the operation there seemed to be no indication just where to stop, except the strength of the patient. The longitudinal sinus had been penetrated by a spicule and bled viciously on removal of the little fragment. So much blood was lost before this could be effectually closed that I hastily discontinued further attempts, and bent my energies to getting him off the table alive. He died shortly after the dressings were completed. His skull was thin, the bones seemed rather brittle, but this was the most extensive fracture following a common injury that I have ever met with.

A second case of this character was that of a man of forty, who, on the 4th day of April, 1892, fell from a height not exceeding five feet, and was found unconscious. Accounts differ as to whether a stone fell with him and struck his head or not, but at all events there were no perceptible bruises on that or any other part of the body. On the morning following the injury he was up and about the house, walking, using his hands, but not talking,

only replying by an inarticulate murmur to questions, *i. e.*, with aphonia. The evacuations were naturally attended to. During the third night following the injury he became hemiplegic on the right side, and next morning was comatose. I saw him with Drs. Harrington and Niemand, and found the right side absolutely paralyzed; the man presented all the ordinary signs of compression, save that the pupils responded to light. On careful palpation no tumor could be detected, nor any external evidence of fracture.

The conjunctiva of the right eye was suffused, but not that of the left. As a last resort, operation was undertaken, to see if brain-pressure could be relieved. A very little chloroform was required. A large 5 cm. trephine was applied over the left motor area rather low down, and this in spite of the fact that, now that his head was shaved, we could see a faint linear ecchymosis behind the opposite (right) ear. Even now, before exposing the bone, we could detect no certain sign of fracture, although fracture at the base was suspected. The skull was of average thickness. After removing the button of bone the dura appeared a little darker than natural. It was opened, and it was seen that there was some laceration of the brain-substance. The most striking feature was the markedly increased intra-cranial pressure. On further exploration a little clot was removed from beneath the dura, but the pressure increased. I then passed the needle of an exploring syringe in the direction of the lateral ventricle. At a depth of 6 cm. I found fluid blood and removed 12 or 15 c.c. with the syringe. I then passed a director down alongside the needle and evacuated more than 30 c.c. of semi-fluid blood. After its removal the pressure was so reduced that the cortex subsided below the proper level, and

the man at once began to move his right arm. I then passed a catgut drain into the ventricle and closed the dura and external wound. The patient displayed little or no signs of shock, but died four hours later of pulmonary edema. A hurried autopsy was made, and upon removing the calvarium it was found that there was complete diastasis of the longitudinal suture extending well down anteriorly and posteriorly, and that the halves of the skull were almost ready to fall apart. Their level, however, was not altered, and with all the work that I did upon the skull during the operation, no such fracture as this was suspected. A line of fracture was also found running down toward the right ear below the ecchymotic spot already noted. There were several small clots just beneath the dura, scattered over the surfaces of both hemispheres, and upon the right side some plastic exudate. At the base, especially in the right anterior fossa, was considerable thin clot. In the left hemisphere, about an inch beneath Broca's center, was a firm clot of the size of a grape. Numerous minute hemorrhages bespoke the extensive lacerations inflicted upon the brain.

Here again surprise is excited that so many and such lesions can occur with so slight immediate serious signs and results.

A few years ago, alluding to trephining for intracranial hemorrhage, Hutchinson said that "the modern annals of surgery do not contain any cases of hemorrhage in which life has been saved by trephining for this state of things." This statement was put on record, although at the time numerous cases were in print which completely disproved it, and of which its writer seemed to be ignorant. At present that surgeon must be considered as repre-

hensible who fails to open the skull in every case in which indications of early or late hemorrhage are met with aside from the localizing symptoms commonly looked for. It is stated that high temperature coming on suddenly, with slow stertorous respiration, diminishing consciousness and hemiplegia after an interval of consciousness, may be regarded as conclusive evidence of hemorrhage from the middle meningeal artery. Of the brilliant results that have followed the diagnosis and exploration of such cases surgical literature is full. The essential advance made has been in systematizing the indications, and popularizing the operative attack. The most progressive surgeons, moreover, are coming to the conclusion that even in cases of mild hemorrhage it is best to trephine, in order to avoid the risks of a small clot retained in the cranial cavity. Indeed, Horsley, to whom we owe so much, is on record as claiming that every case of fracture of the skull should be trephined. For my own part, and so far as the danger of the operation is concerned, I can only say that so far as I know among my own cases, in never a single instance has the essential danger of a patient been enhanced by trephining or other operative attack; and I desire to ally myself with those who consider that trephining, properly done, adds scarcely any appreciable danger, while it offers a most important prospect of relief, and one which no conscientious surgeon would willingly disregard or deprive his patient of.

Brain-tumors.

With intra-cranial solid tumors I have had comparatively small experience. In one case, referred to me by Dr. Putnam, in which we regarded a tumor as certainly present, but were unable to decide positively whether it was cortical or located along the deep paths of conduction, I made an exploratory operation, which proved of no avail, and in fact ended fatally within forty-eight hours.

In another case referred to me by the same gentleman, we were both convinced of the presence of a tumor, but regarded it as inaccessible. After watching the patient's suffering for a long time, we decided to operate purely for the relief of tension, and I trephined, doing practically nothing but removing a large area of bone, with complete relief of her distressing headache, which relief continued up to the time of her death from the natural consequences of the disease. I have seen quite a number of cases of brain-tumor with reference to operation, but have in most of them declined to operate, while in those in which I was willing to do my part, the patients have declined the proffered relief. A somewhat perplexing case came under my notice not long ago, in the person of an elderly woman, who fell down stairs and struck her head, and who a few days later became comatose, and developed a peculiar sighing respiration with frequent hiccough. I was invited by Dr. Diehl to see her with reference to operation, but could find no operative indications. She died on the following day, and on autopsy there was found acute menin-

gitis of ordinary type. On removing the brain, a peculiar condition of the lower surface of the cerebellum was observed, and after its removal a cluster of cystic growths was found, which were attached a little to one side of the middle line, upon the lower surface of the cerebellum, where they had made depressions into which they seemed to fit. One of these was of the size of a small grape, two of the size of large peas, and there were several quite small ones. They had a peculiar pearly sheen, were cystic in character, although their walls were quite thick, and upon minute examination proved to be cholesteatomata. We learned that during the last few months of her life the patient had developed a frequent, though not constantly staggering gait, and that at times she complained of giddiness and vertigo.

Epilepsy.

No discussion of brain-surgery nowadays, in which the surgical treatment of epilepsy has been disregarded, has been noted in recent surgical literature, and for very obvious reasons. My own experience in this direction has been, I imagine, like that of most other surgeons—*i. e.*, a very mixed and contradictory one. I have had some very brilliant results, and, I think, a few positive cures; and, on the other hand, I have operated without noticing the slightest permanent improvement. In no distinctly epileptic case has any harm been done by the operation, unless there be included in this category two cases of linear craniotomy to be spoken of later. If I may be permitted to state my present

opinion concerning the surgical treatment of epilepsy, it would be about as follows: There are certain cases in which prognosis is very favorable; there are others in which the operation must be regarded as an absolute experiment, albeit upon scientific principles; and there are still others which, although accompanied by focal symptoms or other features that ordinarily necessitate operation, we must regard as absolutely hopeless; it is seldom possible to designate to which class a case belongs until the operation is tried. But I think that this statement ought to be tempered by another, to the effect that surgery alone is rarely, if ever, sufficient, and that it must be accompanied and followed, and, perhaps, even be preceded, by medicinal and dietetic treatment, and that this feature of these cases is too often disregarded. To this second statement should be added, perhaps, a third, to the effect that when operating for pronounced epilepsy we have to combat not only a somatic lesion, but an epileptic habit, so to speak, and that a mere removal of the lesion is not necessarily or always enough to break up the well-formed habit; that it is this which calls for the long-continued post-operative treatment which often causes discouragement and carelessness, and, finally, inattention and absolute disappointment. I firmly believe that if those who operate frequently for epilepsy would steadily and subsequently treat their cases by the other measures alluded to, and keep them up for five years, at the expiration of that time much better results would be reported than we now hear of. This refers not only to cases of head-injury in which the conventional operations about the skull

are performed, but also to peripheral irritations in other parts of the body, necessitating various other operations.

Of purely head or brain cases of this character, I will only call attention to two or three. One was a case operated on in 1884:

A man aged twenty-three, when a boy, fell into the water and struck upon a submerged timber, and was unconscious for two days afterward; he later developed epilepsy, and was afterward in the hospital on Ward's Island and escaped from there when they proposed operation to him. He was picked up in a fit on a Buffalo street, and sent to our hospital. Upon admission he was having at least one fit every day. There was a distinct depression on one side of the median line. The overlying skin was very sensitive. The operation was performed on December 6, 1884; the bone was very thick (2 cm.), with external depression, but none of the internal table could be made out; the external sensitive area was excised. For some days he was violently disturbed; then he showed material improvement, save that on the last day of the year he had several fits, but none during the preceding ten days. Respiration became so embarrassed as to call for artificial aid. A few days later he was sent to the Almshouse, where he had a number of seizures, during one of which a pail of cold water was thrown over him. He quickly recovered, and had no more while there. He left the institution in May, was reported as not having had any fits in three months, but has not since been heard from.

The first case attempted in this country in accordance with the principles of cerebral localization was in a patient upon whom I operated Nov. 16, 1886:[1]

[1] Vide Trans. Cong. Am. Phys. and Surg., vol. i, p. 285.

The patient was a man of forty-seven, who more than a year previously had been thrown and dragged upon the ground. Four hours later he became unconscious, although there was no external violence to the skull. He was unconscious for sixty-eight hours, and gradually recovered. He developed nearly absolute aphasia, his vocabulary being limited to perhaps a half dozen words. His right arm was also paralyzed and cold. His epileptic condition developed four months after his injury, and became very pronounced. His lesion was diagnosticated as cystic degeneration of a clot, and its position correctly determined. Upon trephining it was found as expected, only perhaps larger. A cyst was discovered with capacity of 40 c.c. of fluid, in dimensions 10 by 3 cm. It was dissected out, and the patient made a perfect recovery from the operation. His epileptic and aphasic condition, however, have since then only in small measure improved. This latter condition I can explain by atrophy of the third parietal convolution, due to pressure of the cyst. For the former I can give no more satisfactory explanation than in any such case.

Three or four similar cases in which cysts have been accurately diagnosticated and indicated either by localizing symptoms or by external scars, have been operated upon after much the same fashion, with results in every case encouraging, but in no case completely satisfying. It has seemed that in every case the cyst had existed for a time long enough to produce atrophy of the underlying portion of the hemisphere, with permanent loss or disturbance of its proper functions.

In one case operated upon last year I had an experience with hemorrhage which may be of interest

and encouragement to others. It was one of those instances of traumatic Jacksonian epilepsy with a scar near the middle line of the scalp. The operation was without incident until the dura was opened, and adhesions found between it and the cortex. These were tough and firm, and in the endeavor to remove the adherent portion of the cortex some unusually large veins or abnormal connections with the longitudinal sinus were severed, and the bleeding became serious and even alarming. I finally succeeded to my perfect satisfaction, however, in checking it by packing with iodoform-gauze, the tampon of which I retained *in situ* by the pressure of the overlying skin flap, which I restored to its place after inserting secondary sutures of silk, which were left long and tied by a bow-knot. Two days later I untied the knots, lifted up the flap, removed the tampon without a particle of hemorrhage, restored the flap to place, utilized the secondary sutures for its retention, and got beautiful union by first intention. This patient went home very much improved, but during the hot weather of the past summer was, I have been informed, injudicious and had some return of his old trouble, the seizures never being of so serious a character as before, and being quite controllable so long as he takes bromides and borax in ordinary doses—a line of treatment which I have urged him to continue indefinitely.

Last spring, at the meeting of the American Surgical Association in Boston, Dr. Beach, of that city, presented a case operated upon for traumatic epilepsy, in which, in order to prevent the re-formation of adhesions between the dura and the other tissues

he had inserted a piece of thin gold foil, carefully sterilized, with apparently the best results. Following his example, I have twice operated in the same way, cutting out with a pattern a piece of dentist's foil a little larger than the bone opening, and fitting it in, after closing the dura, between it and the margin of the bony defect, then closing the scalp-wound over it, all without drainage. There has not been the slightest disturbance of any kind, and the progress of these cases, so far as I have been able to judge of them or to hear, has been very encouraging.

This measure (insertion of gold foil) I now intend to introduce and recommend in recent accident cases in which trephining is practised for depressed fractures, etc., for the purpose of preventing adhesions between the scalp and dura.

In another case, in a young lady with Jacksonian epilepsy, in which the aura usually commenced in the arm, and in which there were noticed also what my colleague, Dr. Putnam, has been recently the first to call attention to, namely, sleep-movements in the same arm, I last spring exposed the arm center, determined its exact location with the faradic coil, and excised the same as accurately as I could to the depth of 1 cm. Perfect primary union took place, but the result has been disappointing, there having been only slight amelioration of the symptoms. In her case, however, we have had to contend with peculiar gastric symptoms, dilatation of the stomach, etc., which seem to have had a marked influence in depriving her of the benefits legitimately to have been expected from such an operation. Moreover,

she has a peculiar idiosyncrasy, in that she cannot take bromides in any form without the development of intense bromism, her body showing many scars of ulcers produced in the attempt to bring her under the influence of the drug.

Psychopathic Equivalent of Epilepsy: Dementia Epileptica.

Under this head recent writers have included cases not of distinctly epileptic type, but of paroxysmal, emotional, and epileptiform character, the attacks coming on sometimes with and sometimes without auræ or other premonitory symptoms. I have operated upon three well-marked cases of this character within the past few months.

The first was in a man of thirty-one, who, July 20, 1891, was kicked in the left side of the head by a horse, and who some time later was found unconscious. He was carried into the house, and was aroused. He had no paralysis, but in three days began to act strangely and soon became wilful and almost violent. He developed erotic tendencies, and growing rapidly worse could not be kept at home. On July 28th, he was sent to me by Dr. Krehbiel, of Yorkshire Center. At this time the patient was difficult to control and mildly maniacal. July 29th, I found a depressed area on the left side near the parietal eminence and a little anteriorly to it; yet he had absolutely no motor symptoms. At this point there was an H-shaped scar. Immediate operation was done under chloroform. Beneath the scalp I found a depression about the size of a half-dollar, around which I chiselled so as to entirely lift and remove the depressed portion.

The bone was well comminuted; there was a small clot beneath the bone, but none beneath the dura. The bone was not replaced and the wound was closed without drainage. He made a rapid recovery; returned home in one week with his mind nearly clear and his disposition as it had been before the injury.

My second case was in a man of forty-five, who, when a young man, had had an extensive compound fracture of the skull, and who for a while was under the observation of the late Dr. Gray, of Utica, who advised against operation, in accordance with the practice of his day. Of late years the man has developed distinct epileptiform seizures followed by violent maniacal attacks, during which he was positively dangerous, so that his family lived in constant fear; moreover, his disposition and temper seemed to be gradually changing under this stress, and it got to be a question whether he should submit to an operation or be sent to an asylum. He was placed in my hands for operation by Dr. Putnam. This was made during October, 1891, the depressed bone being removed, adhesions separated, and a portion of the scar exsected. The change in this case for the better has been most marked and most gratifying. While it is too much to say that he has not had a single seizure since the operation, they have been reduced to very mild and very rare attacks, and I believe it is now some months since he had anything that could be called a fit. In temper and disposition he is also quite his old self again.

A third case is one very recently operated on, so that I cannot report final results. A man of about thirty, had at the age of five sustained a bad compound fracture of the left side of the skull, and was so profoundly and long unconscious that for two or

three days absolutely nothing was done for him by the physician in his community. He married some twelve years ago, and since his marriage has had nearly weekly attacks of faintness, but never of convulsive character, which have been followed by sullenness and manifestations of quick temper that have greatly alarmed his family. Inasmuch as there was about the head at the site of the old injury a dense and depressed scar, I ascribed his nervous symptoms to the remote effects of injury, rather than to those of his marriage. In his case I completely dissected out the scar, trephined and removed a small circular depression of bone, inserted a piece of gold foil, slipping its edges beneath those of the bone, and closing the wound as usual without drainage. Up to the moment of publication, this case has done uninterruptedly well.

Linear Craniotomy, or Craniectomy.

My experience with this new and radical procedure has been sufficiently varied and interesting, even important, to justify individual report of each case. I will first give them in the order of their occurrence.

Case I.—J. V., aged three and one-half years, was referred to me by Dr. Crego. As a baby he was restless and "jerky," and when nine months old had convulsions of the entire body. As he grew older he would sometimes fall in some of the attacks. These slowly assumed the conventional epileptic type, and by the time he was three years old, or in March, 1891, were perfect examples of *grand mal*. They also increased in frequency and severity. At that time he began staggering in his gait, and his left leg grew weak. Soon after it showed relative de-

crease in length and size. His temper became violent and uncontrollable, his epileptic seizures more and more frequent, and during the twenty-four hours previous to the operation he had between thirty and forty distinct and severe seizures. Though he was by no means an imbecile, his mental development was retarded. His skull seemed relatively small for his age. On June 21, 1891, I operated on him at the General Hospital. A long incision, one inch to the right of and parallel with the middle line, was made from the forehead to the occiput. With cutting bone-forceps I excised a strip of bone 2 cm. wide from the line of growth of hair in front nearly to the occipital protuberance behind. Then detaching the scalp for the purpose, I excised a narrow strip of bone over the fissure of Rolando on the right side down nearly to the temporal fossa. The wounds were closed without drainage. During the ensuing twenty-four hours shock was severe, and the child had several violent epileptic seizures. Since this first day he has never had another. His irascibility has subsided, his general health and intelligence have improved; he now runs, plays, acts, and talks just like other children of his age.

Case II.—Minnie R., aged four years, was referred to me by Dr. Putnam. This was a case of congenital microcephalus and imbecility. The parents were healthy, and the family history was good, the previous children being sound. This girl had scarcely ever spoken a word, and manifested no more intelligence than an infant of three months. Her fontanels closed very early. She leads a vegetable sort of existence—without disturbance of function. Operation here seemed much less hopeful than in the previous case; it was, nevertheless, undertaken July 13, 1891. An incision was made 3 cm. to the left of the middle line, from 4 cm.

above the left superciliary region to the occipital protuberance. A strip of bone was excised much nearer to the middle line. After removing it the scalp was pressed away on the left side and a strip excised over the Rolandic fissure. I then made an incision over the right Rolandic fissure, and excised another strip of greater length, the three lines of defect having a common meeting-place. The central grooves were cut with forceps, the lateral grooves with a chisel. There was no great hemorrhage, and the wounds were closed without any provision for drainage. The child nearly collapsed after the operation, and for two days required constant attention. The after-results in this case have been practically *nil*. There has seemed to be a perceptible improvement in intelligence, and the child has appeared a little more alive to what is going on about her, and this is about all that can be said.

Case III.—W. K., aged eighteen years, was referred to me by Dr. Crego. From an early age the patient's mental development has been very disappointing. He is physically large and well developed, but mentally shows scarcely more intelligence than a child of two or three years. At the age of about five he first showed epileptic manifestations. His seizures were then few and far between. They gradually increased in frequency, until now he has several in one day, but may possibly go a few days without any. His temper is usually good, but at times he is excessively wilful. The upper portion of his cranium is relatively small, though not conspicuously so. The muscles of his right side are somewhat atrophied. It seems that his epileptic fits have been somewhat more violent on the right side than on the left. His personal habits are good, as is also his family history. Dr. Crego and myself both thought that an extensive cranial opening might

give relief, and the experiment was proposed and accepted by the father. Operation was done October 20, 1891. A long incision was made to left of the middle line. When I endeavored to make a longitudinal division of the skull, commencing with a common amputating saw, I found that the bone was very thick. I then applied a trephine over the motor area, and, through the opening thus made, with chisel and gouge-forceps removed a portion of bone, some 5 cm. in diameter, and in shape like a spherical triangle. Through a small opening in the dura I found that there were no adhesions, but that the arachnoid and pia were succulent and edematous. I started to make a longitudinal excision of bone, but finding the same to be 1 cm. thick, desisted from this attempt, and tried to make simply a large relief-opening. The wound was closed with catgut, and an ice-bag applied outside the dressing. At 6 P.M. the boy was somewhat restless, and had a fit. This condition became more marked, and by midnight, in spite of considerable morphine and other sedatives, he was convulsively restless and violent, and required both a strait-jacket and chloroform. At 4 A. M. he died of exhaustion.

CASE IV.—J. M., aged fifteen years, was healthy until he was three years old. Then his nurse used to frighten him, and he grew to be very nervous and timid. He soon began having fits every night, until he was thirteen years old, when they occurred in the daytime also. Shortly after this he was having from thirty to forty fits every day. During one of these he fell and broke his elbow, which is now partially ankylosed. He also cut his forehead to the bone. For the last two years he has been lying most of the time helpless in bed, and has had to be fed. His symptoms, mental and

convulsive, seemed to occur in cycles of about three weeks each. During the first week of the three he would be noisy, in the second he would be weeping and wailing, and during the third apathetic and almost unconscious. He rarely spoke. All the the children of this family were rhachitic. November 2, 1891, the boy was brought to my clinic in this third stage, and it seemed impossible to arouse him. He took mechanically most of what was put into his mouth. His bed was constantly soiled. His arms, and sometimes his legs, were nearly always in the athetoid condition, and any little disturbance would bring on a mild seizure, during which his arms were drawn up over his head. There were no scars over his motor areas. November 7, 1891, the operation was carried out at clinic. A long incision was made to the left of the middle line, and after a first opening of the trephine a long strip of bone, 1 cm. wide and 13 cm. long, was removed just to the left of the longitudinal sinus. The operation had to be discontinued because of collapse. The patient stopped breathing, nearly died on the table, and was revived with great difficulty. The wound was closed as rapidly as possible. He seemed better the same evening, but next day the athetosis continued; he became uneasy, and died, twenty-six hours after the operation, of shock.

Case V.—S. P., aged nine years. This patient is of Russian-Jewish parentage, his father being an educated man, and the other children healthy. He presents a defective skull-development, especially over the left frontal lobe; is imbecile and epileptic; has seizures coming on about every five days. His forehead slopes backward so as to give him somewhat the appearance of an Aztec child. Mentally he is an imbecile, mutters half a dozen words, staggers about the room, but in disposition is

good-natured and even confiding. He was operated upon November 14, 1891, at my clinic. In this instance I varied the ordinary procedure in that I laid up a V-shaped frontal flap, its apex reaching nearly to the vertex of the skull, its extremities extending nearly to the external angular processes. Then a small trephine was applied on each side of the middle line; the opening thus made was connected across the longitudinal sinus, and then two strips of bone were excised in a direction parallel to the scalp-incisions, by which considerable spring was given to the frontal bone and the fragments of others attached to it. The operation proceeded without incident, and the first dressing was not made until eight days later, when perfect union was found. The immediate effects in this case were not very pronounced; the seizures, however, became less frequent and less severe, and when the boy left the hospital a few weeks later he had lost his staggering gait, and his various actions and attempted speech showed much more fixedness of purpose than was previously the case. But at the end of a year the results in his case have to me been astounding. He has had no fit for three months, and within a week or two was again exhibited at my clinic. He came up to me and publicly asked in clear and distinct tones whether he could go to school. I held some conversation with him before my class, in order to show that he was capable of rational thought and rational and even accurate conversation. In addition to this he has developed physically, and his face now has a really intelligent expression, whereas a year ago it was expressionless.

Case VI.—C. S., aged twelve years, of Warren, Pa., was sent to me by Dr. Baker. This child was also an imbecile, speaking but few words, being at times irascible, and having at times frequent epi-

leptic seizures. There was partial paresis of the left arm, although she used it more or less. In her case there was great asymmetry, there being a great depression over the right side. She was operated on the same day as the previous case at a special clinic given for these two cases, and a strip of bone about 1 cm. wide was excised to the right of the middle line, extending well backward and forward into the frontal bone. The dura was not opened. At the first dressing, one week later, perfect union of the wound was found, and a light dressing only was applied. A few hours later she got restless and tore this off, and then picked the wound open so that it gaped for its whole distance. It was immediately re-dressed after disinfection with hydrogen dioxide, but healed the second time by the slower process of granulation. During the few weeks of her stay in the hospital she improved a little. A letter from Dr. Baker, dated October 25, 1892, nearly a year later, states that "she is no better now than she was before operation. For the first three months after operation there was a marked lessening in the number of paroxysms, but for the last three months the convulsions have been both severe and frequent, she having several daily. She is in much the same condition mentally that she was before operation."

From the foregoing reports it will be seen that I have had six cases of this general character, of which two were promptly fatal, two have been practically unaltered, and two have been brilliantly successful beyond all expectation. Of the two fatal cases I can only say that they belong to a class of patients about whom in general we feel that death is vastly preferable to such a life, and while I think that the second case might have been benefited had

he survived the shock, I regard the first as having been essentially and absolutely hopeless in every respect. Save in a purely personal sense, I have no regret for the operation, which was freely assented to by the parents. In fact, in every one of these cases the parents have been made fully aware of the difficulties and dangers, and have in every instance said that they would rather lose their children than see them live in the condition in which they were at the time of the operation.

The two cases in which no result has been noted I suppose must be regarded as belonging to the class of cerebral atrophies that have been stigmatized by Dr. Starr as essentially hopeless. In both of these cases the principal regret of the parents is that their children survived the operative ordeal.

Of the two successful cases any man might well feel proud as having contributed to such marvellous changes. They are of themselves sufficient reward and justification for a score of unsuccessful cases, and lend an element of hope in similar instances of which the profession should not be deprived.

Case VII.—Since writing the foregoing I have operated upon an infant of fourteen months who was born during a natural labor, of a healthy mother who had borne other healthy children. The child shows no ordinary signs of rickets, but its fontanels closed very early, and it shows scarcely any more sign of intelligence than does a vegetable. It seems to recognize the difference between light and darkness, to have the sense of hearing reasonably acute, and is physically in good condition. Her principal evidence of life and activity is her constant crying

at night, so that her mother told me that she has had practically no rest since the child was born. In this instance the father said to me, with tears in his eyes: "Do all you can, and be sure to do what you think is enough, without stinting operation; for I had rather bring the child away from the hospital in a coffin than in this condition." Operation was made the same way as in Case V, but the child, who stood the operation well, collapsed, and died suddenly the same evening.

Without prolonging this paper to too great an extent, I desire before closing to invite attention to a few conclusions, the results of my deliberate convictions and reflections upon this kind of work.

1st. We have not yet learned the possible limits of brain-surgery, so-called, or the possible limits to which we may with reasonable safety interfere with the functions of the brain or its component parts. Final knowledge in this respect will come probably rather through clinical experience than through experimental investigation.

2d. I have had a number of brain-cases whose history shows that at the time of reception of injury the symptoms were so serious and severe as to lead the medical attendants to consider the case hopeless, so that practically nothing was done. I wish to say all I can to condemn this apathetic course, and to urge that the most desperate case be attended to at once, with the same attention to detail as though it were quite hopeful in its outlook.

3d. In many of my own cases, and my experience is like that of many others, the mental or other disturbance that has finally led to operation has been

allowed to run along, often for years and years, and patients have been brought to the surgeon only as a last resort. This course is as unwise in these cases as when we deal with malignant disease, and the profession generally should learn that the prognosis would be very much more favorable in such cases were they operated upon when these disturbances first make their appearance.

4th. Personal experience has convinced me that when I have erred in operating for epilepsy or psychic disturbance, it has been rather on the side of doing too little than too much. For instance, in one of the cases alluded to under the caption Epilepsy, in which no improvement was manifested, I am now sorry that I did not take out so much of the arm-center as to produce at least temporary paralysis of the arm. In other words, I have never regretted doing too much, but in several cases have regretted not doing more than was done.

5th. I wish again to insist upon the necessity of long-continued medicinal and dietetic treatment after these cases have passed out of the hands of the surgeon.